PROTECTIVE LAYER(S) IN ORGANIC IMAGE SENSORS

REFERENCE TO RELATED APPLICATION

This Application is a Continuation of U.S. application Ser. No. 14/316,946 filed on Jun. 27, 2014, the contents of which are incorporated by reference in their entirety.

BACKGROUND

Digital cameras and other digital imaging devices use arrays of millions of tiny photodetectors or pixels to record an image. For example, when a cameraman or camerawoman presses his or her camera's shutter button and exposure begins, each photodetector in the array is uncovered to detect the presence or absence of photons at the individual array locations. To end the exposure, the camera closes its shutter, and circuitry in the camera assesses how much light (e.g., how many photons) fell into each photodetector while the shutter was open. The relative quantity or intensity of photons that struck each photodetector are then stored according to a bit depth (0-255 for an 8-bit pixel). The digital values for all the pixels are then stored and are used to form a resultant image.

Conventional solid state image sensors are made up of an array of photodetectors which individually include PN junctions made of semiconductor material, for example, silicon disposed in a semiconductor substrate. Color filter arrays (CFAs) with separate color filters for red, blue, and green light are often arranged over photodetector arrays to differentiate between different colors of light. When an incident light ray has a large angle of incidence, the light can easily pass through one color filter into other neighboring color filters and/or other neighboring photodetectors underneath the color filters. Thus, a shield or re-direct element is inserted between photodetectors of different colors to reduce the crosstalk between photodetectors of different color filters, which otherwise will ultimately cause noise that distorts the resultant digital images.

BRIEF DESCRIPTION OF THE DRAWINGS

Aspects of the present disclosure are best understood from the following detailed description when read with the accompanying figures. It is noted that, in accordance with the standard practice in the industry, various features are not drawn to scale. In fact, the dimensions of the various features may be arbitrarily increased or reduced for clarity of discussion.

FIG. **1**A illustrates a cross-sectional view of some embodiments of an organic image sensor.

FIG. **1**B illustrates a cross-sectional view of some other embodiments of an organic image sensor.

FIG. **2** illustrates a cross-sectional view of some other embodiments of an organic image sensor.

FIG. **3** illustrates a top view of some embodiments of an organic image sensor.

FIG. **4** illustrates a flow diagram of some embodiments of a method of forming an organic image sensor.

FIGS. **5**A-F illustrate some embodiments of cross-sectional views of a method of forming an organic image sensor.

DETAILED DESCRIPTION

The following disclosure provides many different embodiments, or examples, for implementing different fea-

tures of the provided subject matter. Specific examples of components and arrangements are described below to simplify the present disclosure. These are, of course, merely examples and are not intended to be limiting. For example, the formation of a first feature over or on a second feature in the description that follows may include embodiments in which the first and second features are formed in direct contact, and may also include embodiments in which additional features may be formed between the first and second features, such that the first and second features may not be in direct contact. In addition, the present disclosure may repeat reference numerals and/or letters in the various examples. This repetition is for the purpose of simplicity and clarity and does not in itself dictate a relationship between the various embodiments and/or configurations discussed.

Further, spatially relative terms, such as "beneath," "below," "lower," "above," "upper" and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the figures. The spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. The apparatus may be otherwise oriented (rotated **90** degrees or at other orientations) and the spatially relative descriptors used herein may likewise be interpreted accordingly.

One type of solid state image sensor is an organic CMOS image sensor (CIS) that includes an organic photoelectrical conversion structure arranged between upper and lower electrodes. When incident radiation of sufficient energy strikes the organic photoelectrical conversion structure, an electron-hole pair is created. Due to a bias applied across the electrodes, the hole is accelerated toward one of the electrodes (e.g., towards the lower electrode acting as an anode), while the electron is accelerated toward the other electrode (e.g., towards the upper electrode acting as a cathode). In this way, the incident radiation produces a photocurrent between the electrodes, wherein the current level of this photocurrent is proportional to the intensity of the incident radiation absorbed.

To help decrease leakage, some organic CISs include electron-blocking and/or hole-blocking layers between the organic photoelectrical conversion structure and the various electrodes. For example, a hole-blocking layer can be inserted between the organic photoelectrical conversion structure and the cathode (e.g., upper electrode) to hinder holes moving from the cathode to the organic photoelectrical conversion structure. Similarly, an electron-blocking layer can be inserted between the organic photoelectrical conversion structure and the anode (e.g., lower electrode) to hinder electrons moving from the anode to the organic photoelectrical conversion structure. Thus, these electron/hole blocking layers can help to decrease leakage and improve efficiency of the cell. Unfortunately, in previous approaches, an electron- or hole-blocking layer is formed directly over an exposed surface of the organic photoelectrical conversion structure so the electron- or hole-blocking layer abuts the exposed surface of the organic photoelectrical conversion structure. In particular, this overlying electron- or hole-blocking layer is deposited by plasma vapor deposition (PVD), and this plasma process can damage the exposed surface of the organic photoelectrical conversion structure, thereby degrading the performance of the CIS.

Therefore, to ward off this potential PVD-damage, some embodiments of the present disclosure include one or more protection layers to help protect the surface of the organic photoelectrical conversion structure from plasma damage. In